If you are using a printed copy of this procedure, and not the on-screen version, then you MUST make sure the dates at the bottom of the printed copy and the on-screen version match.
The on-screen version of the Collider-Accelerator Department Procedure is the Official Version.
Hard copies of all signed, official, C-A Operating Procedures are kept on file in the C-A ESHQ Training Office, Bldg. 911A.

C-A OPERATIONS PROCEDURES MANUAL

2.5.2 RHIC Accelerator Safety Envelope Parameters

Text Pages 2 through 10

Hand Processed Changes

HPC No.	Date	Page Nos.	Initials

Approved: ***Signature on File*** _____
Collider-Accelerator Department Chairman — Date

E. Lessard

2.5.2 RHIC Accelerator Safety Envelope Parameters

1. Purpose

1.1 This procedure assigns responsibility for the Accelerator Safety Envelope Parameters for the RHIC Collider, STAR experiment, and PHENIX experiment, based on the Accelerator Safety Envelope, and any subsequent USIs documented using C-A OPM 1.10.1, Unreviewed Safety Issues.

1.1.1 Additionally, the Collider, STAR, PHENIX, PHOBOS, and BRAHMS and other experiments, are limited by ESH requirements established by the C-A Radiation Safety Committee (RSC), the C-A Accelerator Systems Safety Review Committee (ASSRC), and the C-A Experimental Safety Review Committee (ESRC). C-A safety-committee requirements are documented in RSC, ASSRC, and ESRC Checkoff Lists in the Main Control Room (MCR). These Checkoff Lists must be completed before allowing reviewed systems to become operational, or allowing beam in the Collider, or allowing beam collisions for experiments.

1.2 Implicit in the notion of an Accelerator Safety Envelope Parameter is that variations in operating conditions are permitted if and only if they do not exceed the defined boundaries. A variation beyond the boundaries described below shall be treated as a reportable occurrence, as defined by SBMS Subject Area on Occurrence Reporting. Notifications of occurrences shall be made according to C-A OPM 10.1.

2. Responsibilities

2.1. The C-A Department Chairman shall approve all changes to the Accelerator Safety Envelope Parameters (ASEPs).

2.2. The On-Duty Operations Coordinator is responsible for ASEPs in Steps 5.1.1, 5.1.3, 5.1.4, 5.3.1, 5.4.1, 5.5.1 and 5.6.1.

2.3. The Radiation Safety Committee is responsible for 5.1.2.

2.4. The Liaison Physicists for the Collider and the Collider experiments shall be responsible for the ASEP in Steps 5.1.4, 5.1.5 and 5.2.1.

2.5. The C-A ESH Coordinator is responsible for the ASEP in Steps 5.6.2

2.6. The C-A Associate Chair for Operations is responsible for the ASEP in Step 5.7.1.

2.7. The C-A Access Controls Group Leader is responsible for the ASEP in Step 5.4.2, 5.4.3, 5.4.4, 5.4.5, 5.4.6 and 5.4.7. Bypass of PASS shall be in accord with C-A OPM 4.92.

2.8 The Cryogenic Systems Group Leader is responsible for the ASEP in Step 5.8.1.

2.9 The Cryogenic Shift Supervisor is responsible for the ASEPs in Steps 5.5.2, 5.5.3 and 5.8.2.

2.10 The C-A Facilities and Experimental Support Group Head is responsible for the ASEPs in Steps 5.9.1, 5.9.2, 5.10.1 and 5.12.

2.11 The Liaison Physicist for the STAR experiment is responsible for the ASEP in Step and 5.9.3 and 5.10.4.

2.12 The Liaison Physicist for the PHENIX experiment is responsible for the ASEP in Steps 5.10.2, 5.10.3 and 5.10.4.

2.13 The Chairman of the Experimental Safety Review Committee is responsible for the ASEP in step 5.11.

3. Prerequisites

None

4. Precautions

None

5. Procedure

Accelerator Safety Envelope Parameters are established for:

- Collider Beam Intensity and Particle Loss
- Radiological Area Classification
- RSC and ESRC Checkoff Lists
- Particle Accelerator Safety System
- Oxygen Deficiency Hazard Control
- Fire Protection

- Main Control Room Staffing
- Cryogenic Control Room Staffing
- STAR Experiment
- PHENIX Experiment

5.1 Collider Beam Intensity Limit and Limiting Particle Loss

5.1.1 The Operations Coordinator shall maintain the maximum number of heavy ions in each ring to be equal to or less than the equivalent of 2.4×10^{11} Au ions at 100 GeV/u. Examples of equivalence are as follows:

5.1.1.1 Deuterium – 1.2×10^{13} ions per ring at 125 GeV/u

5.1.1.2 Oxygen – 2×10^{12} ions per ring at 125 GeV/u

5.1.1.3 Silicon – 1.34×10^{12} ions per ring at 125 GeV/u

5.1.1.4 Copper – 6.48×10^{11} ions per ring at 115 GeV/u

5.1.1.5 Iodine – 3.6×10^{11} ions per ring at 104 GeV/u

5.1.2 The C-AD Radiation Safety Committee prior to injection into RHIC must consider each new species.

5.1.3 The Operations Coordinator shall maintain the maximum number of protons in each ring to be equal to or less than the equivalent of 2.4×10^{13} at 250 GeV.

5.1.4 The Operations Coordinator shall routinely interpret loss monitoring results and RCT radiation survey results in order to maintain beam loss, "As Low As Reasonably Achievable", as defined in the BNL Radiological Control Manual.

5.1.5 The Liaison Physicists for the Collider, or the Collider experiments, shall provide the Operations Coordinator with OPM Procedures that will allow the Operations Coordinator to control radiation levels.

5.1.5.1 In no case shall beam loss induced radiation within uncontrolled areas be greater than 0.5 mrem in an hour, or for chronic losses be greater than 100 mrem in a year.

5.1.5.2 In no case shall beam loss induced radiation in a Controlled Area be greater than 5 mrem in an hour.

Note:
Controlled Areas at RHIC include any posted Controlled Area portions of the AtR.

5.2 Procedure to Classify Radiological Areas

5.2.1 The Liaison Physicists for the Collider, or the Collider experiments, shall ensure changes to classifications of radiological areas are in accord with the requirements in the BNL Radiological Control Manual.

5.3 Completion of RSC and ESRC Checkoff Lists

5.3.1 The Operations Coordinator shall ensure all relevant RSC, ASSRC and ESRC Checkoff Lists are completed and signed before allowing beam into the associated accelerator, transfer line, or experimental program; e.g., AtR operations, Collider operations, PHOBOS operations with Collider beam, etc.

5.4 Particle Accelerator Safety System

5.4.1 During operations, the MCR Operations Coordinator shall notify Collider Experiment Shift Leaders when PASS is inoperative.

5.4.2 The Access Controls Group Leader shall ensure that safety-system configuration control and maintenance shall be in accordance with C-A OPM 4.91.

5.4.3 The Access Controls Group Leader shall ensure the radiological portions of the Access Controls System are functionally tested according to the requirements in BNL RadCon Manual, Chapter 3, Appendix 3A.

5.4.4 The Access Controls Group Leader shall ensure that accessible ODH ventilation fans that are signaled by the PASS are functionally tested before the running period. Accessible fans and air inlet louvers shall be manually tested semiannually (not to exceed 8 months), or within one month of accessibility.

5.4.5 The Access Controls Group Leader shall ensure that area radiation monitors that are interfaced with the Access Controls System are within their calibration date.

5.4.6 The Access Controls Group Leader shall ensure high intensity proton beam is prevented from the W line, either by the Access Controls System or by RSLOTO of appropriate critical devices.

5.4.7 The Access Controls Group Leader shall ensure that the locations of area radiation monitors are maintained as defined by the C-A Radiation Safety Committee.

5.5 Oxygen Deficiency Hazard Control

Note 1: Personnel may be escorted into ODH areas without completion of training (ODH 0 or 1 areas) or medical exam (ODH 1 areas). Untrained personnel shall not perform work in ODH areas.

Note 2: The following apply when the MCR is staffed and/or the Cryo Shift is staffed for operations.

5.5.1 IF EITHER an oxygen sensor is not working, OR less than three ventilation fans in a Sextant of the Collider tunnel are available for operation, AND the temperature of helium in the Collider Tunnel is below 50 degrees Kelvin, THEN the MCR Operations Coordinator shall only allow work in the affected Sextant of the Collider Tunnel if:

5.5.1.1 an Enhanced Work Planning Form has been completed for moderate hazard, AND
5.5.1.2 personnel performing the work are ODH 1 trained.

5.5.2 IF EITHER an oxygen sensor is not working, OR less than one ventilation fan in a Collider support building is available for operation, AND the temperature of helium in the Collider support building is below 50 degrees Kelvin, THEN the Cryogenic Shift Supervisor shall only allow work in that Collider support building if:

5.5.2.1 an Enhanced Work Planning Form (BNL F3093A) has been completed for moderate hazard, AND
5.5.2.2 personnel performing the work are ODH 1 trained.

5.5.3 IF EITHER an oxygen sensor is not working, OR less than three ventilation fans in the compressor building are available for operation, AND the temperature of helium in the Collider support building is below 50 degrees Kelvin, THEN the Cryogenic Shift Supervisor shall only allow work in the compressor building if

5.5.3.1 an Enhanced Work Planning Form (BNL F3093A) has been completed for moderate hazard, AND

5.5.3.2 personnel performing the work are ODH 1 trained.

Note:
Tunnel sextant 1 is from 12 o'clock to 2 o'clock; tunnel sextant 3 is from 2 o'clock to 4 o'clock, etc. Sextants 5 and 7 do not include the STAR IR and sextants 7 and 9 do not include the PHENIX IR

5.6 Fire Protection

5.6.1 The on-duty Operations Coordinator shall take appropriate action if fire detection/protection systems are impaired. These actions may either be to prohibit personnel from working in a specific area, and/or to de-energize equipment.

5.6.1.1 Collider magnets and power supplies may be energized if the smoke detection system for the energized area can transmit an alarm to summon the Fire/Rescue Group. Transmittal may be automatic or via a fire watch.

5.6.1.2 Personnel may occupy the tunnel if the exhaust fans can be activated manually or automatically.

5.6.2 The ESH Coordinator shall ensure the Plant Engineering Division has tested the Fire Protection system annually (not to exceed 15 months between tests).

5.7 Main Control Room Staffing

5.7.1 To ensure an adequate number of qualified personnel in the C-A Main Control Room, as a minimum, one Operations Coordinator and one Operator shall be on duty when beam is in operation. During normal operations, one shall remain in the Main Control Room at all times.

5.8 Cryogenic Control Room Staffing

5.8.1 The Cryogenic Systems Group Leader shall ensure a watch is provided in the Cryogenic Control Room when the refrigerator is in operation. The Shift Supervisor, or a qualified Cryogenic Operator, can be designated by the Cryogenic Systems Group Leader as the sole watch stander.

5.8.2 One Cryogenic Shift Supervisor, or designee, shall remain in the Cryogenic Control Room at all times when the refrigerator is in operation, unless the controls are relocated to the Main Control Room, or unless emergency conditions require actions to be taken by all cryogenic watch standers.

5.9 STAR Experiment

5.9.1 The C-A Facilities and Experimental Support Group Head shall ensure the following whenever flammable gas is in the integrated detector positioned in the IR:

5.9.1.1 Flammable gas detection systems, both STAR and PASS, are operational and functionally tested.

5.9.1.1.1 The PASS functions of the flammable gas detection system are to be tested in accord with requirements in BNL RadCon Manual, Chapter 3, Appendix 3A.

5.9.1.1.2 The STAR functions of the flammable gas detection system are to be tested annually.

5.9.1.2 If the SVT is operational, then the detector ventilation system shall be delivering flow.

5.9.1.3 At least one of the two emergency exhaust fans is available and functionally tested annually.

5.9.1.4 Purge gas operational requirements are specifically defined in the approved STAR Operating Procedures for the detector.

5.9.1.5 The TPC gas used in the detector is P-10 or equivalent hazard.

5.9.2 The C-A Facilities and Experimental Support Group Head shall ensure the following whenever electronics are powered in the integrated detector in or out of the IR:

5.9.2.1 The Highly Sensitive Smoke Detection (HSSD) system on the detector or the ceiling-level HSSD system is operational and functionally tested.

5.9.3 The STAR Liaison Physicist shall ensure, via the ESRC Checkoff List, that whenever flammable gas is in the integrated detector:

5.9.3.1 A quantity of purge gas is maintained to dilute the detector flammable gas volumes below 25% of the LEL.

5.9.3.2 When the TPC is in operation, no more than 80 cubic meters of methane gas at STP is attached to the gas mixing system.

5.9.3.3 A qualified local watch is provided.

5.10 PHENIX Experiment

5.10.1 C-A Facilities and Experimental Support Group Head shall ensure the following whenever flammable gas is in the integrated detector positioned in the IR:

5.10.1.1 Flammable gas detection systems, both PHENIX and PASS, are operational and functionally tested.

5.10.1.1.1 The PASS functions of the flammable gas detection system are to be functionally tested in accordance with requirements in the BNL RadCon Manual, Chapter 3, Appendix 3A,

5.10.1.1.2 The PHENIX functions of the flammable gas detection system are to be tested annually.

5.10.1.2 The building HVAC ventilation is delivering flow and both emergency exhaust fans are available.

5.10.1.2.1 The emergency fans are to be functionally tested annually.

5.10.1.3 Purge gas operational requirements are specifically defined in the approved PHENIX Operating Procedures for the detector.

5.10.1.4 The detector and ceiling level HSSD systems are operational and functionally tested.

5.10.1.5 The High Capacity Ventilation System is operational and functionally tested before the introduction of flammable gas into the RICH.

5.10.1.6 The interstitial space between the RICH and the Pad Chamber FEE is inerted when introduction of flammable gas is in the RICH.

5.10.2 The Liaison Physicist for the PHENIX experiment shall ensure the following whenever electronics are powered in the integrated detector in or out of the IR:

5.10.2.1 The electronics racks interlocks in the IR are operational and functionally tested annually.

5.10.2.2 The Highly Sensitive Smoke Detection (HSSD) system on the detector or the ceiling-level HSSD system, is operational and is functionally tested annually.

5.10.3 The Liaison Physicist for the PHENIX experiment shall ensure the following, via the ESRC Checkoff List, whenever flammable gas is in the integrated detector:

5.10.3.1 A qualified local watch is provided.

5.10.3.2 A quantity of purge gas is available to dilute the detector flammable gas volumes below 25% of the LEL.

5.10.4 If personnel occupy an IR after flammable gas is present, then the Liaison Physicist for the PHENIX or the STAR experiment shall ensure, via the ESRC Checklist, that the personnel plug door and the emergency escape labyrinth are available for egress.

5.11 Shutdown Periods

5.11.1 During shutdown periods, specific safety requirements for the experiments shall be reviewed on a case-by case basis by the ESRC and approved by the Chair of the ESRC.

5.12 Groundwater Protection

5.12.1 The C-A Facilities and Experimental Support Group Head shall ensure the water-impermeable covers over the stops and collimators at RHIC and W line are inspected annually.

6. Documentation

None

7. References

7.1 RHIC SAD.
7.2 Accelerator Safety Envelope for RHIC
7.3 BNL RadCon Manual, Chapter 3, Appendix 3A
7.4 C-A-OPM 1.10.1, “Procedure for Documenting Unreviewed Safety Issues”.
7.5 C-A-OPM 4.91, “Configuration Management Plan for the C-A Access Controls System”.
7.6 C-A-OPM 10.1, “Occurrence Reporting and Processing of Operations Information”.

8. Attachments

None